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This strength was taken for the trial, comparison being made with a much stronger solution, and also with pure water. The trial was made in duplicate, one set in the green-house, the other in the open ground, the other conditions being the same. The seed was soaked in each case twenty-four hours, and planted May 17, 100 kernels in a place as in the other tests. The examination was made daily, and, as in the other cases, as nearly as practicable at the same hour, usually at 6 a. m. The record begins on the day upon which the first plants appeared above ground.

IV.—*Copperas upon corn.*

Date.	(*a*) In the green-house.			(*b*) In the open ground.		
	Water.	Copperas, 1 pound per bushel.	Copperas very strong.	Water.	Copperas, 1 pound per bushel.	Copperas very strong.
May 24	51	35	16	12	1	1
May 25	84	70	45	45	32	20
May 26	91	79	68	68	65	59
May 27	94	86	72	80	76	73
May 28	94	87	80	82	80	74
May 29	94	88	85	83	81	79
May 30	94	93	86	84	86	79

A comparison of Tables IV with Tables I and II is sufficient to show that green vitriol (copperas) has nearly as injurious an effect upon the seed as blue vitriol. There was no scorching of the leaves noticeable, however, resulting from treatment with copperas, even with the strongest solution.

TREATMENT OF BLACK-ROT, BROWN-ROT, DOWNY MILDEW, POWDERY MILDEW, AND ANTHRACNOSE OF THE GRAPE; PEAR SCAB AND LEAF-BLIGHT, AND APPLE POWDERY MILDEW.

By B. T. Galloway.

BLACK-ROT.*

The experiments of the past two years have demonstrated beyond question the possibility of cheaply and effectively preventing this disease. Many things, however, in connection with its treatment remain to be discovered, so that rules now laid down will probably have to be modified, as future work gives us a better insight into the nature of the disease and the effects of different fungicides upon it. In the light of our present knowledge we would suggest the following lines of treatment, from which we will leave our readers to make their own selec-

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***Lœstadia Bidwellii*, (Sacc.) V. R.

tions, since there is little choice, so far as the actual value of the remedies are concerned.

I. After pruning, collect and burn all the trimmings, also as many of the old berries and leaves as possible; the object of this is to destroy the fungous spores which are known to pass the winter in these parts. This accomplished, watch the vines carefully, and as the leaves begin to unfold apply the Bordeaux mixture, formula *b*, taking care to have it reach all parts of the vine above ground. About the time the flowers are opening make a second application of the same formula, this time giving particular attention to the green parts. A third spraying should be made twelve or fifteen days later, a fourth after the lapse of a similar period, and so on until the berries begin to color. A line of treatment, such as the foregoing, will necessitate six or seven sprayings, and the total cost of the same will probably range from $5.50 to $7 per acre, or practically 1 cent per vine.

II. Treat the vines exactly as in I, excepting the first application, which may be omitted entirely, the first spraying being the one made when the flowers are opening. It is not out of place to say here that in no case should the first spraying be postponed later than the last-mentioned period. This treatment will, of course, cost less than I, but whether it will pay to omit the first spraying is one of the questions not yet determined.

III. Treat the same as I, but after the third application abandon the Bordeaux mixture and substitute the ammoniacal solution of copper carbonate. It is very likely that this treatment will prove as effectual as I; at the same time the cost will be less, and the troublesome spotting of the fruit, which always results from the use of the Bordeaux mixture, will be avoided.

IV. Substitute the ammoniacal copper carbonate for the Bordeaux mixture, making the first spraying when the flowers are opening and the others the same as in I. Former experiments have led us to believe that in ordinary seasons this solution will prove as effective as the Bordeaux mixture, and its advantages over the latter are (*a*) ease of preparation and application, (*b*) cheapness, and (*c*) its property of not spotting the fruit.

Those desiring to make further trials should test the effect of spraying the vines in spring, before vegetation starts, with the simple solution of copper sulphate or Bordeaux mixture, formula *a*. It is claimed by some that this early treatment has resulted in much good, but on the other hand there are those who have derived no benefit whatever from it. The question is one to be settled by careful experiments. For further remarks on this subject, see Notes on Fungicides.

BROWN-ROT AND DOWNY MILDEW.*

These diseases, which are caused by the same fungus, occur in nearly all sections where black-rot prevails, and experience has shown that one treatment will answer for all. In the great grape-growing regions of northern Ohio and central and eastern New York, where the downy mildew is the principal enemy, the ammoniacal copper carbonate solution will prove an effectual preventive. It should be applied thoroughly to all the green parts of the vine, taking care to make the first application *before any signs of mildew have appeared*—say, soon after the berries are well set. The importance of early treatment can not be too strongly urged. In all cases it must be remembered that these treatments are *preventive*, and being such, it is sheer folly to wait until the enemy appears before beginning the fight.

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* *Peronospora viticola*, DBy.

POWDERY MILDEW.*

It is only in certain parts of the South and along the Pacific coast that this fungus causes any serious damage. In California it has long been the bane of the grape grower, and this is strange, considering the fact that it is one of the easiest diseases to combat. It succumbs readily to sulphur either in the form of the flowers of sulphur or solutions of the sulphide.

In applying the sulphur, bellows should be used, and the first applications should be made ten or twelve days before the flowers open, the second when in full bloom, and a third three weeks or a month later if the disease seems to be on the increase. The best results are obtained when the applications are made with the thermometer ranging from 80 to 100° F. In this temperature fumes are given off, which quickly destroy the fungus.

We have obtained excellent results in treating this disease with a solution made by dissolving half an ounce of potassium sulphide to the gallon of water. This preparation is cheap and can be quickly and effectually applied with any of the well known spraying pumps. The greatest care should be exercised in making the second spraying, which, by the way, should be at the same time as that mentioned for the flowers of sulphur, in order to protect the blossoms from the fungus.

ANTHRACNOSE.†

This is one of the most difficult of all the grape diseases to combat; in fact we must admit that so far no reliable means of preventing it are known. We can only suggest, therefore, such lines of treatment as have given the best results, hoping that future investigations may throw more light on the subject.

In early spring, before the buds swell, remove, so far as possible, the wood showing the scars made by the fungus, and then treat the vines with a saturated solution (20 per cent. at 20° C.) of iron sulphate. The French apply this by means of mops made of rags, attached to short handles. This is rather slow and awkward work, and we prefer to do it with a spraying machine. As soon as vegetation starts watch the vines carefully, and at the first appearance of the disease apply

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[*] *Uncinula ampelopsidis*, Pk.

[†] *Sphaceloma ampelinum*, DBy.

with a sulphuring bellows a powder made of equal parts of flowers of sulphur and slaked lime. If this does not check the malady, try the sulphur alone.

PEAR SCAB* AND LEAF-BLIGHT.†

Excepting the well known fire blight these diseases are the worst enemies of the pear. They are especially prevalent in New Jersey, Delaware, and adjoining States, frequently causing the loss of entire crops of fruit and thousands of seedlings. The seedlings are especially subject to leaf-blight, but are hardly ever, so far as we know, seriously injured by scab. As the two diseases, however, are usually associated on large trees, and as we have used the Bordeaux mixture successfully on the seedlings, we would suggest that it be adopted for all and applied as follows:

Seedlings.—Make five applications, the first when the leaves are one-quarter grown, others at intervals of ten days until the trees are budded.

Large trees.—Spray five times; first when the fruit is the size of peas, and thereafter at intervals of twelve or fifteen days.

For applying the mixture to trees less than 12 feet high, and especially to seedlings in the nursery, the knapsack pumps provided with the improved Vermorel lance and nozzle will answer.

Where the trees are large and in considerable numbers it will pay to get a strong force-pump, mount it on a barrel, and place the whole in a wagon or cart to be moved about at pleasure. In all cases, however, it will be necessary to use the Vermorel nozzle, as it is the only nozzle of value that will not clog; it can readily be attached to almost any force-pump, and will be found to be a very effective piece of machinery.

The total cost of a course of treatment such as is outlined above, including labor in preparing and applying the remedies, will be for nursery stock about $3 per 1,000 trees. For large bearing trees the cost will run from 6 to 12 cents per tree. In case the Bordeaux mixture shows on the fruit at the time of harvesting it can easily be removed by washing in water.

In addition to the foregoing it would be well to rake the old leaves and fruit together in the fall and burn them, as in this way thousands of the reproductive bodies will be destroyed.

In regions where the scab alone prevails the treatment recommended for apple scab might be tested.

POWDERY MILDEW OF THE APPLE.‡

Powdery mildew is especially destructive to seedlings in the nursery, attacking them soon after the leaves unfold and continuing throughout the growing season, making it impossible to bud them with any degree of success.

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* *Fusicladium dendriticum*, Fckl.

† *Entomosporium maculatum*, Lév.

‡ *Podosphæra oxyacanthæ* (DC.), DBy.

When the leaves are about one-third grown begin the treatment by spraying with the ammoniacal solution. In twelve days make a second application of this solution and continue at similar intervals until six or seven sprayings have been made. The applications are best made with the knapsack form of sprayer provided with the Eddy chamber nozzle. The spray of the Vermorel nozzle is too large for this work, but the Eddy chamber can be easily attached to the lance of the former at a cost of 75 cents.

The total cost of such a treatment as outlined above need not exceed 10 cents per 1,000 trees.

WHAT TO DO FOR PEACH YELLOWS.

By Erwin F. Smith.

A series of experiments with fertilizers was begun in 1889, and will be continued until complete and definite results are reached. These experiments are in twelve orchards in different localities and on a variety of soils, embracing a total of about 40 acres, with as many more for comparison. The results last year were not of such a nature as to warrant any affirmative conclusion or any general recommendation.

For the present, at least, I can only indorse the Michigan practice, which is to dig out and destroy every affected tree as soon as it is discovered.

In localities where this method has been practiced with some uniformity they still grow peaches successfully.

In the vicinity of Benton Harbor, Mich., where all the orchards were ruined between the years 1870 and 1880, there are now many fine young orchards, and the yellows has almost disappeared. In the summer of 1889, in company with Mr. Rufus H. Brunson, a former yellows commissioner, I visited many small orchards in different parts of the townships of Benton and St. Joseph, the former chief seat of the disease, and examined nearly 30,000 trees, finding only about fifty cases, nearly one-half of which were in one orchard. More than four-fifths of these trees were less than six years old. Many of the older ones, and most of those which I examined, were in fruit, and the earliest varieties were just coming into market, July 24. With a few exceptions, the only *extensive* orchards were young trees not yet in bearing, the earlier plantings having been numerous, but in a small and tentative way, no single individual caring to risk many thousand trees. Now, however, large orchards are being set. Whether the present immunity will continue is a matter of great interest. If there is any real basis for the belief that the disease may be imported, it certainly will not, for many of the younger trees were procured from infected districts in the East. All fear of the disease seems to have died out, and with it most of the former vigilance.